QUARTERLY REPORT

(for July - September 1993)

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OCEAN OBSERVATIONS WITH EOS/MODIS: Algorithm Development and Post Launch Studies

by

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Following the format of my monthly reports, I shall describe developments (if any) in each of the major task categories.

1. Atmospheric Correction Algorithm Development.

   a. Near-term Objectives:

      (i) Implement the proposed SeaWiFS atmospheric correction algorithm (the MODIS prototype) on an image processing system, and begin estimation of the computational resources required to process SeaWiFS data.

      (ii) Complete paper exploring the effects of earth curvature on the performance of the SeaWiFS correction algorithm.

   b. Task Progress:

      (i) Through collaboration with R. Evans and J. Brown, the SeaWiFS atmospheric correction algorithm has been implemented on our image processing system and tested with CZCS imagery. Operating with SeaWiFS data, the algorithm uses measured radiances near 765 and 865 nm (where the ocean is essentially a black body) to

correct the radiances in the visible for atmospheric effects. CZCS has only half of the spectral bands of SeaWiFS with no bands in the NIR. Thus, there are no bands for which the ocean can be absolutely approximated as a black body. To test the implementation with CZCS data, we used "clear" water imagery, e.g., the Sargasso Sea, for which the water-leaving radiance is known at three of the bands (520, 550, and 670 nm) and used the algorithm to derive the water-leaving radiance at 443 nm. The resulting water-leaving radiances were typically within one sensor digital count of the radiances derived with the standard CZCS atmospheric correction algorithm. This suggests that the implementation software contains few coding errors; however, tests of the adequacy of the algorithm must await SeaWiFS data.

The CZCS test provided estimates for the minimum computational resources required to run the algorithm. The timings that were determined for a single processor are provided in the table below. They refer to a CZCS image with about 50% clouds. Cloud pixels are not processed but they are counted in the total.

Computer	Freq. (MHz)	Rate (Pixels/s)
SGI 4D/480	40	181
SGI Indigo 2	150	509
DEC 3000/400	133	569
DEC 3000/500	176	679
DEC 7000/610	183	860

(ii) A paper exploring the effects of earth curvature on the performance of the SeaWiFS correction algorithm is being prepared.

c. Anticipated Activities During the Next Quarter:

(i) Complete implementation and testing of the proposed SeaWiFS algorithm. Begin to study potential avenues for improvement for the application to MODIS.

(ii) Submit paper exploring the effects of earth curvature on the performance of the SeaWiFS correction algorithm to Applied Optics.

(iii) Add a third layer to our radiative transfer code to study the effects of stratospheric aerosols.

2. Whitecap Correction Algorithm.

a. Near-term Objectives: Analyze whitecap data obtained during measurements off the U.S East Coast in mid June.

b. Task Progress: None, data has not been received from NRL.

c. Anticipated Activities During the Next Quarter: When data is received from NRL we will effect an analysis. Also, we expect to complete a quantitative examination of the performance of the atmospheric correction algorithm in the presence of whitecaps.

3. In-water Radiance Distribution Schedule.

a. Near-term Objectives: None.

b. Task Progress: None.

c. Anticipated Activities During the Next Quarter: None.

4. Residual Instrument Polarization.

a. Near-term Objectives: None.

b. Task Progress: None.

c. Anticipated Activities During the Next Quarter: None.

5. Direct Sun Glint Correction.

a. Near-term Objectives: None.

b. Task Progress: None.

c. Anticipated Activities During the Next Quarter: None.

6. Prelaunch Atmospheric Correction Validation Schedule.

a. Near-term Objectives: Use sky radiance measurements in Monterey Bay in August to develop and test schemes for inverting them to retrieve the aerosol optical properties, especially the phase function at large scattering angles.

b. Task Progress: Data of Sky radiance and aerosol optical thickness were obtained during the Monterey Bay cruise. Images have been produced and those suitable for processing have been isolated. Two test cases were examined in detail and one was determined to be unsuitable for analysis. Analysis is continuing on a second image and preliminary results indicate that the data are reasonable.

c. Anticipated Activities During the Next Quarter: We plan to continue the analysis of sky imagery for the aerosol optical properties. We hope this will allow us to identify the significant experimental and computational problems involved in the retrieval process and to begin to address them.

7. Detached Coccolith Algorithm and Post Launch Studies.

a. Near-term Objectives: None.

b. Task Progress: None.

c. Anticipated Activities During the Next Quarter: None.

8. Post Launch Vicarious Calibration/Initialization.

a. Near-term Objectives: None.

b. Task Progress: None.

c. Anticipated Activities During the Next Quarter: None.

9. Single Scattered Aerosol Radiance and PAR Algorithms.

a. Near-term Objectives: None.

b. Task Progress: None.

c. Anticipated Activities During the Next Quarter: None.

OTHER DEVELOPMENTS

The PI and other personnel on the project devoted virtually all of their effort in July to preparing the Algorithm Theoretical Basis Document (ATBD) for the normalized water leaving radiance. The ABTD's for Normalized water-leaving radiance (along with aerosol products) and detached coccoliths (along with water backscattering coefficient) were delivered to the Team Leader.

The PI reviewed in detail the MODIS Standard Products lists for which he is responsible. The results of the review (attached) were transmitted to Ed Masuoka via e-mail.

The PI prepared a section for the Calibration Algorithm Theoretical Basis Document (ATBD) referring to ocean group calibration plans and methodology. It was submitted by fax to P. Slater, and was shortened at his request. Both versions were forwarded to John Barker.

The PI attended the MODIS Science Team meeting at GSFC in late September, and presented a technique for calibrating the short-wave ocean bands to the Calibration Group.